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Target Emissions and Their Effects on the National Ignition Facility

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Target emissions on the National Ignition Facility (NIF) will include x rays, debris, neutrons, shrapnel, and scattered laser light. The energy in the first four emissions will increase over a period of several years as the capability to field and compress cryogenic targets is realized, and the various in-chamber materials responses become move severe. The deposition of up to 1.8 MJ of laser energy on a target, coupled with induced yields of up to 20 MJ, represents a substantial increase over currently contained ICF sources by a factor of ~10^6 in neutrons and ~100 for x rays and debris. Predictive capabilities have been used by the Target Area Development Team to estimate emissions characteristics and their effects. This paper summarizes predictions of characteristics of emissions and compares such predictions to relevant data available from experiments for the various types of emissions.

An important part of the US-French collaboration is the sharing of data intended to increase our understanding of these emission characteristics. For example, French experiments conducted on the Phebus laser have increased understanding of the generation and effects of shrapnel. Gas gun experiments conducted by both teams have also provided important data that has allowed further understanding of particle impacts on relevant materials, such as B_4C and fused silica. French experiments on Ambiorix (a pulsed power plasma radiation x-ray source) are expected to demonstrate the moderating effects of the rather long pulse of x rays predicted, ~50 ns, on ablation of materials. The results of the experiments conducted by both the French and the US will be summarized, as they apply to the responses of both fused silica and B_4C to the predicted range of emissions.

The expected impacts of these results on NIF chamber operations, such as impacts on the diagnostics, first wall panels, unconverted laser light absorbers, and debris shields will be discussed.

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